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(54) Abstract Title: **A collaborative network service information discovery method and communication device**

(57) A collaborative discovery method is provided for use by a plurality of communication devices (MD1 to MD5), wherein network service information (NSI1) discovered by any device (eg MD1) of the plurality is made available for sharing with and discovering by at least one other device of the plurality (eg MD2 to MD4) by transmitting the network service information (NSI1) wirelessly to the at least one other device (MD2 to MD4), the network service information (NSI1) relating to at least one of a network (N1 to N3) over which a device of the plurality can communicate and a service (S1, S2) which a device of the plurality can use. The network service information comprises network configuration date (operating frequency range, physical layer characteristics, network performance data, quality of service data) relating to a network that enables a device to be configured to communicate over that network.

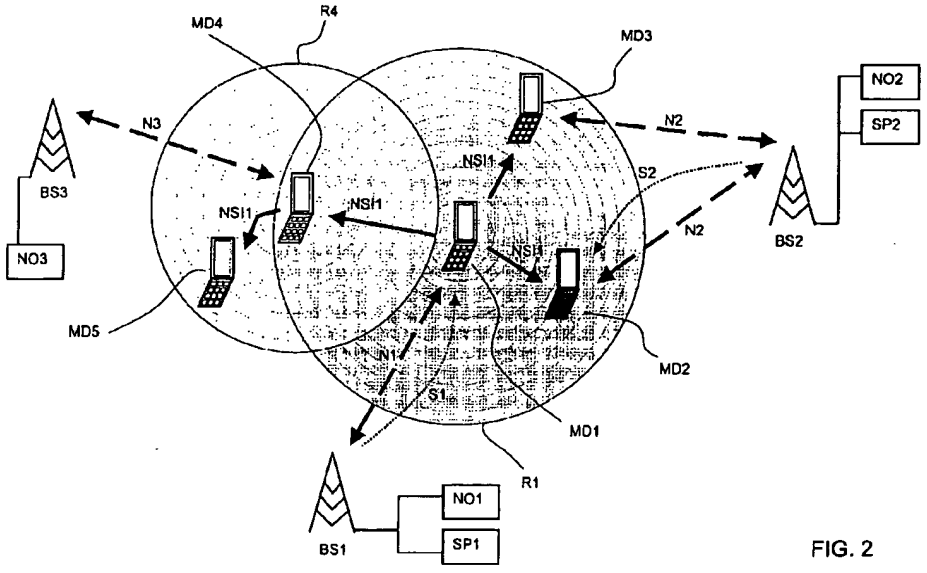

FIG. 2

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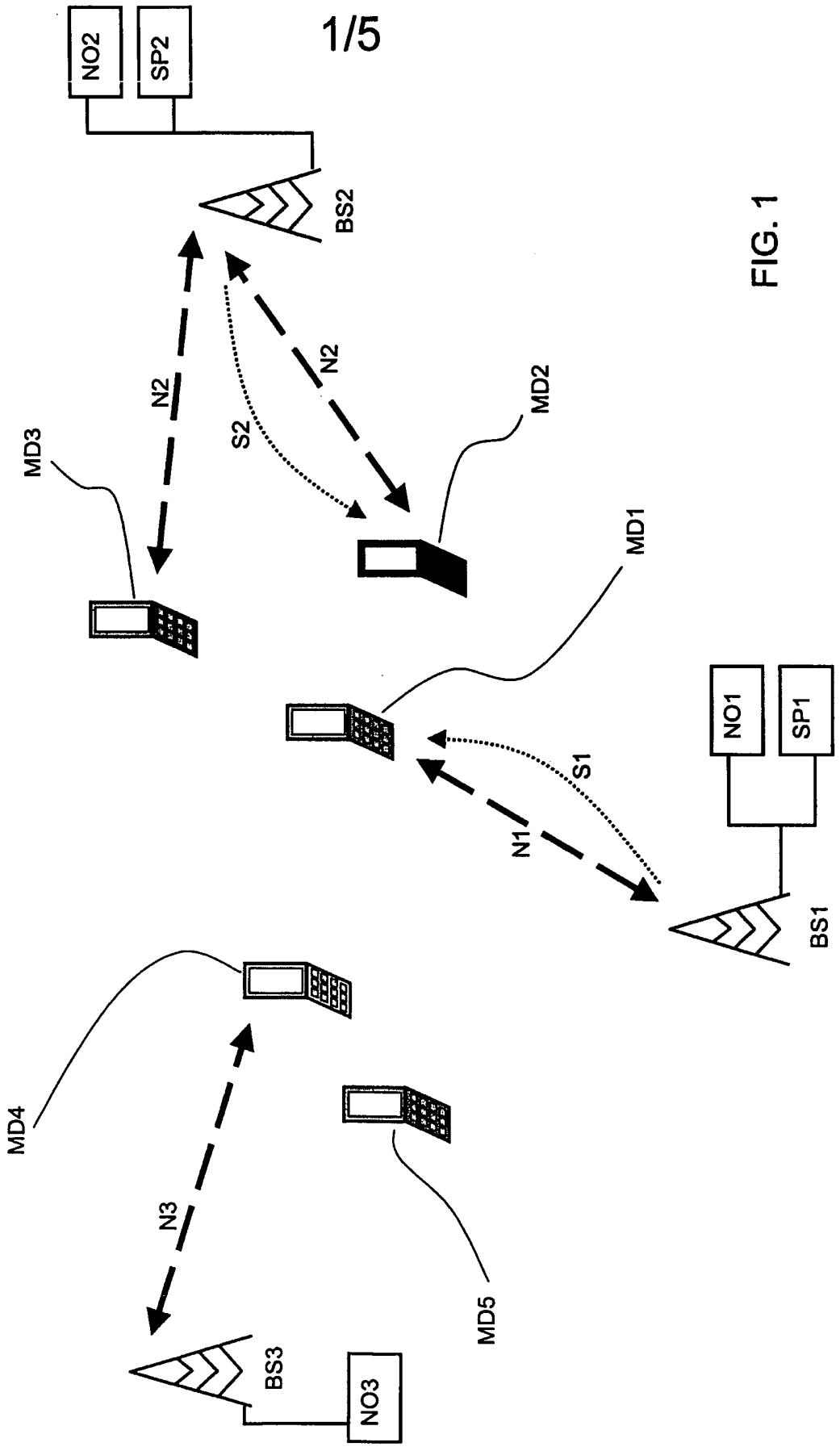
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BS2
N2
S2
N2
MD3
MD2
MD1
NO1
SP1
S1
N1
BS1
MD4
N3
MD5
BS3
NO3

FIG. 1

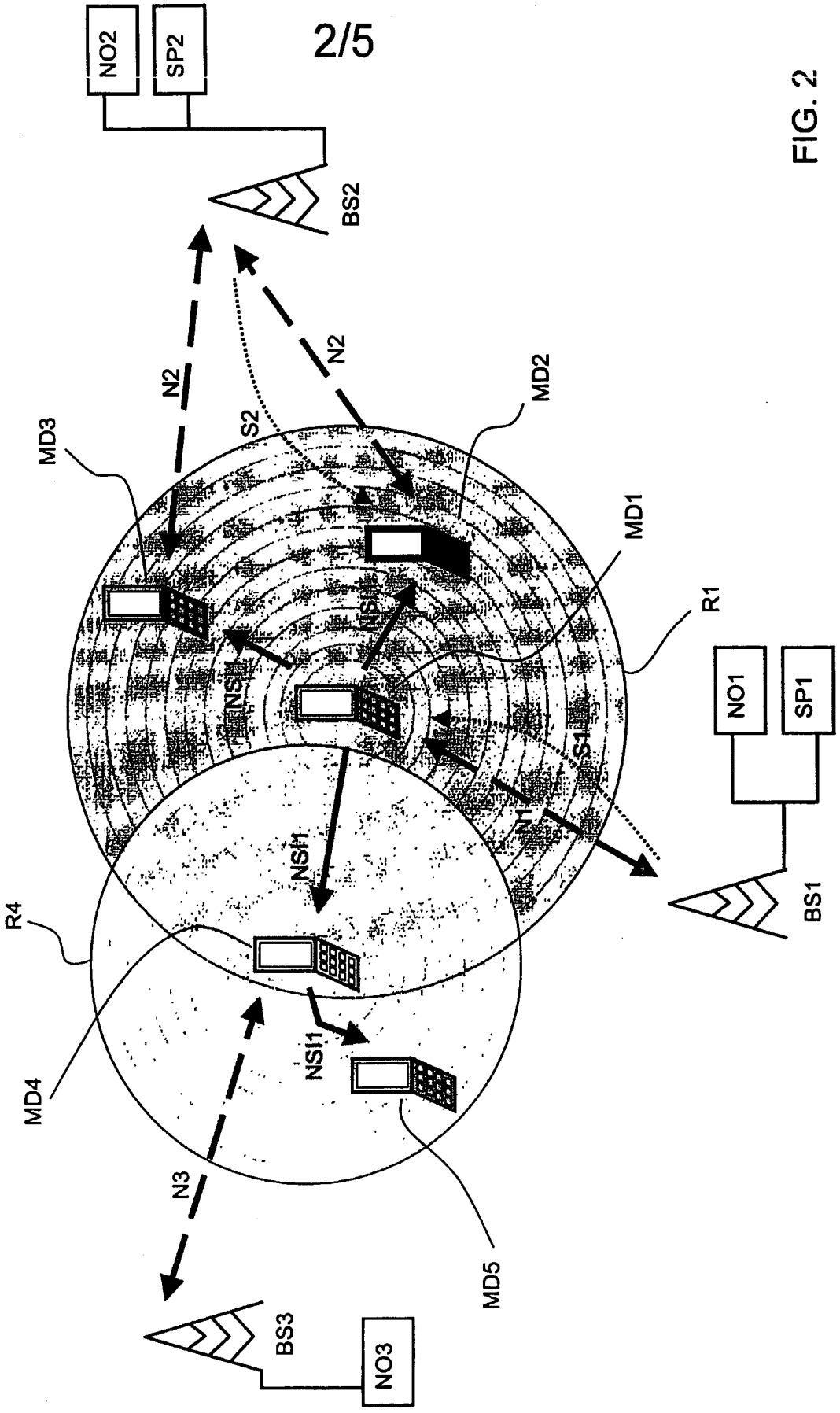

NO2
SP2
BS2
N2
N2
S2
MD3
MD2
MD1
R1
NSI1
NSI1
NSI1
NSI1
S1
N1
NO1
SP1
BS1
R4
MD4
N3
BS3
NO3
MD5

FIG. 2

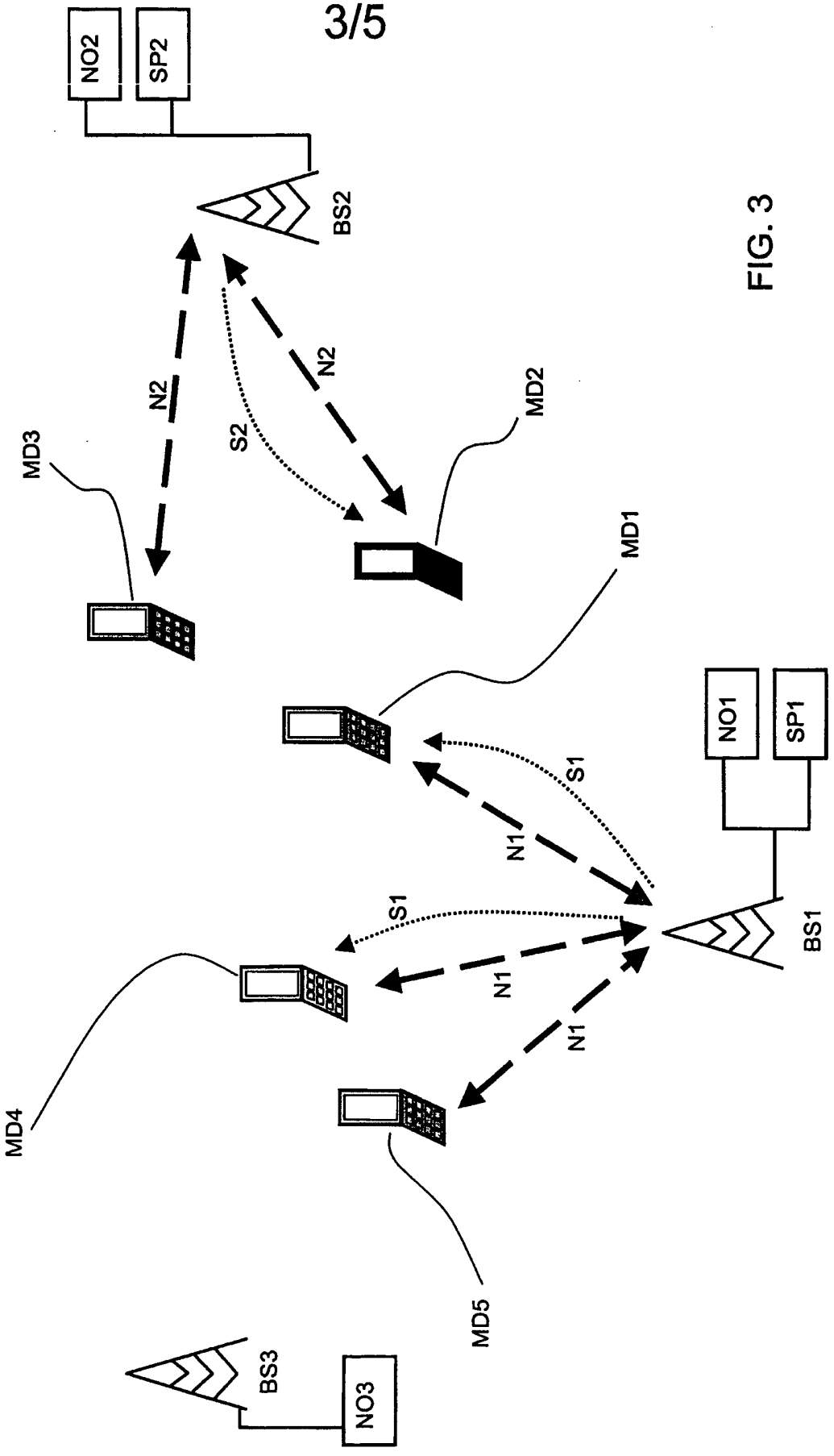
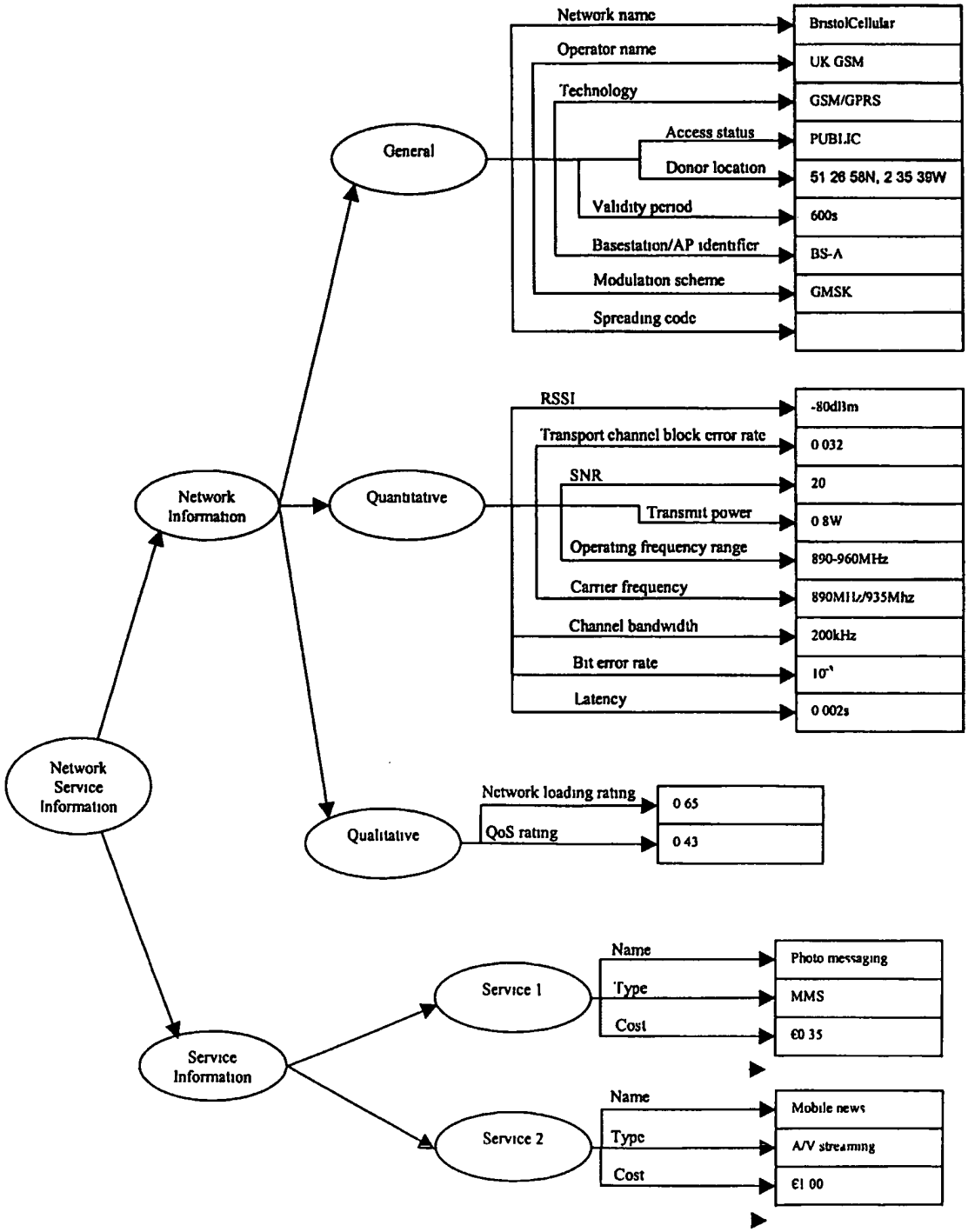

NO2
SP2
BS2
N2
N2
S2
MD3
MD2
MD1
NO1
SP1
S1
N1
S1
BS1
N1
N1
MD4
MD5
BS3
NO3

FIG. 3

FIG. 4


Network Service Information
Network Information
Service Information
General
Quantitative
Qualitative
Service 1
Service 2
Network name
BristolCellular
Operator name
UK GSM
Technology
GSM/GPRS
Access status
PUBLIC
Donor location
51 26 58N, 2 35 39W
Validity period
600s
Basestation/AP identifier
BS-A
Modulation scheme
GMSK
Spreading code
RSSI
-80dBm
Transport channel block error rate
0 032
SNR
20
Transmit power
0 8W
Operating frequency range
890-960MHz
Carrier frequency
890MHz/935Mhz
Channel bandwidth
200kHz
Bit error rate
10^-4
Latency
0 002s
Network loading rating
0 65
QoS rating
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Type
MMS
Cost
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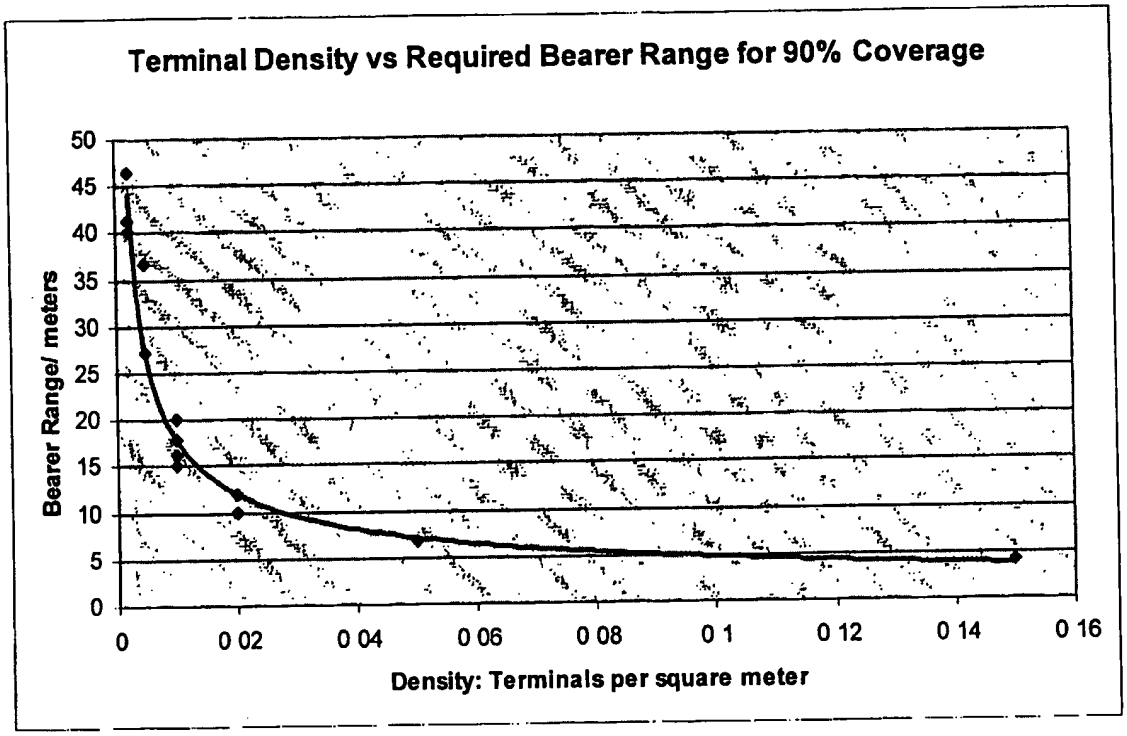
Mobile news
Type
A/V streaming
Cost
€1 00

FIG. 5


Terminal Density vs Required Bearer Range for 90% Coverage
Bearer Range/ meters
50
45
40
35
30
25
20
15
10
5
0
0
0 02
0 04
0 06
0 08
0 1
0 12
0 14
0 16
Density: Terminals per square meter

M&C Folio: GBP89049 Document : 974983

Network Service Information Discovery Method and Communication Device

The present invention relates to a network service information discovery method and a communication device adapted to perform such a method.

Figure 1 of the accompanying drawings is a schematic diagram illustrating the interaction between a plurality of mobile devices MD1 to MD5 with a plurality of network operators NO1 to NO3 and service providers SP1 to SP2. In Figure 1, mobile device MD1 is connected to and communicating over a network N1 provided by network operator NO1. Mobile device MD1 is within communication range of a base station BS1 and the network operator NO1 is using base station BS1 to communicate with mobile device MD1. Similarly, mobile devices MD2 and MD3 are connected to and communicating over a network N2 provided by a network operator NO2 via a base station BS2. Mobile device MD4 is connected to and communicating over a network N3 provided by network operator NO3 via a base station BS3.

Also illustrated in Figure 1 are two service providers SP1 and SP2. Mobile device MD1 is using a service S1 provided by the service provider SP1 over the network N1, while the mobile device MD2 is using a service S2 provided by the service provider SP2 over the network N2. The service provider SP1 may or may not be the same commercial entity as the network operator NO1, and similarly for the service provider SP2 and the network operator NO2. Conventionally it has been the case that a particular network operator would also be the service provider for that network. However, it is envisaged that in the future it will be more common that a user of a mobile device will be able to choose a service provider irrespective of the network operator that is operating the network to which the mobile device is connected. The identity of the service provider is usually of little importance to the user, the type and quality of the service itself usually being of more relevance.

In this example, the network operators NO1 and NO2 are providing a different type of network. Network N1 is a GSM network while network N2 is a UMTS network. Network N3 is of the same type as network N1 (GSM), but is provided by a different network operator and accordingly has a different configuration (e.g. operating frequency range) to that of the network N1.

The most common type of mobile device available is a single-mode mobile device which is adapted and configured to communicate over a single type of network. For example, a single-mode GSM mobile device is not able to connect to a UMTS network.

Second generation mobile phones, such as those that operate according to the GSM system, conventionally detect the presence of available networks by scanning known portions of the radio spectrum. These portions of spectrum are static and are set out on a regional basis by regulators. Since a GSM mobile device operates according to the GSM standard, it will know how to identify a GSM bearer present within the spectrum range scanned. For example, if the mobile device MD5 is a single-mode GSM mobile device then it would perform a network discovery procedure by scanning the GSM operating frequency range to determine that networks N1 and N3 are available, following which it could connect to either of these networks.

Multi-mode mobile devices are capable of communicating over any one of a number of network types. For example, one type of multi-mode mobile device MD is capable of communicating both over a GSM network and a UMTS network. The task of detecting available networks is therefore harder than for a single-mode mobile device.

A re-configurable mobile device takes the multi-mode concept further, and such a mobile device is able to modify its radio, protocol stack, system and application software to operate on a limitless number of networks. Therefore, if a re-configurable mobile device is seeking available networks, it will conceivably need to search for all network technologies. Detecting the presence of alternative modes in a given location is a non-trivial task. The re-configurable mobile device will be required to suspend current activity whilst it monitors the air interface, at a range of frequencies, for a range

of modulation schemes, before returning to its current mode. If the frequency range scanned by the mobile device is large then the time taken to perform the scanning operation could result in the mobile device becoming unavailable for extended periods, which has clear implications for the user. This situation is greatly exacerbated if the mobile device is "in call", in the traditional sense, or otherwise maintaining a communication session. The scanning process also presents a large drain on limited battery resources.

Spectrum for radio communications systems is currently allocated in a static manner. Portions of spectrum are allocated periodically for emerging systems and each system keeps within its spectrum allocation. However, there is pressure to change the way in which spectrum is allocated since operators are at present forced to purchase spectrum before knowing how much of it they actually require. As mobile device technology becomes more flexible and re-configurable, there are proposals to make the spectrum allocation process more flexible too, with the dynamic allocation of spectrum on a temporal or regional basis. This in turn will make the process of network detection and monitoring still harder, since a mobile device will need to scan large portions of spectrum (for example 400MHz to 60GHz) without knowing what type of network technology will be found at any particular frequency. The time to scan will accordingly be very large, service discontinuities are likely and the drain on battery life will be significant.

It is therefore desirable to provide an alternative method for discovery of network and service information.

According to a first aspect of the present invention, there is provided a collaborative discovery method for use by a plurality of communication devices, wherein network service information discovered by any device of the plurality is made available for sharing with and discovering by at least one other device of the plurality by transmitting the network service information wirelessly to the at least one other device, the network service information relating to at least one of a network over which a device of the plurality can communicate and a service which a device of the plurality can use.

The network service information may comprise network configuration data relating to a network that enables a device to be configured to communicate over that network. The network configuration data may comprise one or more radio physical layer characteristics of the network concerned, for example the operating frequency range of the network concerned.

The network service information may comprise service configuration data relating to a service that enables a device to use that service.

The network service information may comprise network performance data relating to the performance of a network. The network performance data may comprise a Quality of Service indication for the network concerned.

The network service information may comprise information identifying a network and/or service.

The network service information may comprise costing information relating to a network and/or service.

A plurality of different network types may be available and at least one device of the plurality may be capable of communicating over more than one network type. One of the network types may be a GSM network.

Each device of the plurality may use a primary communications channel to communicate over a network and at least two devices of the plurality may have a secondary communications channel, different to the primary communications channel, for transmitting the network service information between the at least two devices. The secondary communications channel may be a Bluetooth communications channel. The primary communications channel may be a GSM channel.

The network service information may be transmitted from a device following a request received from another device. The request may be broadcast.

The network service information may be broadcast periodically by a device for receipt by any other device within range of the broadcast.

The network service information may be generated by a device that has connected to the network and/or used the service to which the information relates.

The network service information may comprise time stamp data indicating the time when it was generated or updated by a device and the validity of the information may be dependent upon the time stamp data. The information may be deemed void after a predetermined length of time from the time indicated by the time stamp data.

The network service information may comprise location stamp data indicating the location at which it was generated by a device and the validity of the information may be dependent upon the location stamp data. The information may be deemed void a predetermined distance from the location indicated by the location stamp data.

At least one of the devices may be a mobile communication device.

A service may be provided over a network, or it may be provided direct to a mobile device without using an established network.

According to a second aspect of the present invention there is provided a method of configuring a communication device for connection to a network using network configuration data obtained using a collaborative discovery method according to the first aspect of the present invention.

According to a third aspect of the present invention there is provided a method of reconfiguring a communication device connected to a first network for connection to a second network, different to the first network, based on network service information obtained using a collaborative discovery method according to the first aspect of the present invention.

The communication device may be reconfigured based on network performance data of the network service information. The network performance data may relate to the performance of the first network. The network performance data may relate to the performance of the second network.

According to a fourth aspect of the present invention there is provided a communication device adapted to perform a collaborative discovery method as one of a plurality of communication devices, in which network service information discovered the device is made available for sharing with and discovering by at least one other communication device of the plurality by transmitting the network service information wirelessly to the at least one other device, the network service information relating to at least one of a network over which a device of the plurality can communicate and a service which a device of the plurality can use.

According to a fifth aspect of the present invention there is provided an operating program which, when loaded into a communication device, causes the device to become a device according to the fourth aspect of the present invention.

According to a sixth aspect of the present invention there is provided an operating program which, when run on a communication device, causes the device to perform a collaborative discovery method as one of a plurality of communication devices, in which network service information discovered the device is made available for sharing with and discovering by at least one other communication device of the plurality by transmitting the network service information wirelessly to the at least one other device, the network service information relating to at least one of a network over which a device of the plurality can communicate and a service which a device of the plurality can use.

The operating program may be carried on a carrier medium. The carrier medium may be a transmission medium or a storage medium.

Reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1, discussed hereinbefore, is an illustrative diagram showing the network and service connections established in a conventional manner;

Figure 2 is an illustrative diagram showing the distribution of network service information in a collaborative discovery method embodying the present invention;

Figure 3 is an illustrative diagram showing the network and service connections following the configuration of a mobile device using a collaborative discovery method embodying the present invention;

Figure 4 is a diagrammatic representation of an example of network service information used in an embodiment of the present invention; and

Figure 5 is a graph showing the transmission range required to give 90% coverage for different densities of mobile devices.

Figure 2 is an illustrative diagram showing a communications system having the same basic elements as the communications system shown in Figure 1 but in which the elements are adapted to perform a collaborative discovery method embodying the present invention. In the example described above with reference to Figure 1, the mobile device MD5 would discover the existence of network N1 by performing a conventional spectrum-scanning method prior to the establishment of communication over the network N1. As will be described below, in an embodiment of the present invention a completely different approach is taken which involves the sharing of information already obtained by other mobile devices.

In the communications system of Figure 2, like that shown in Figure 1, mobile device MD1 has already established a network connection over network N1, mobile devices MD2 and MD3 are already communicating over network N2 and mobile device MD4 is already configured to communicate over network N3. Mobile devices MD1 and MD2 are also using services S1 and S2 respectively provided over their respective networks, as was the case with the system described above with reference to Figure 1.

The discovery procedure performed by each of the mobile devices MD1 to MD4 to obtain the necessary network configuration data to enable them to be configured to communicate over their respective networks is not important in the context of an embodiment of the present invention. The network configuration data discovered by these mobile devices could have been obtained by a collaborative discovery method according to an embodiment of the present invention or it could have been obtained by some other means, for example a conventional spectrum-scanning approach.

A collaborative discovery method according to an embodiment of the present invention will be described by considering the discovery procedure employed to provide mobile device MD5 with the necessary network configuration data to enable it to be configured to communicate over the network N1.

Since mobile device MD1 is already communicating over network N1 and using the service S1, the device must have already discovered the necessary network configuration data and service configuration data relating to network N1 and service S1. This configuration data will be referred to herein individually or collectively as "network service information". During the course of normal operation, mobile device MD1 will also take various measurements relating to the performance and quality of the network N1, and this network performance data is also included within the meaning of the term "network service information" which is discovered by the mobile device MD1.

In a collaborative discovery method according to an embodiment of the present invention, network service information NSI1 discovered by mobile device MD1 is made available for sharing with and discovering by other devices of the communications system as follows. In the present embodiment, the network service information NSI1 is broadcast periodically by mobile device MD1 using a secondary communications channel different to the primary communications channel used by mobile device MD1 for communications over the network N1. The secondary communications channel has a range R1 and any mobile device within this range is able to receive the network service information NSI1 broadcast by the mobile device MD1. In the illustration of Figure 2, mobile devices MD2, MD3 and MD4 are within range and therefore capable of receiving the network service information NSI1.

In particular, mobile device MD4 receives, and therefore discovers, the network service information NSI1 and repeats the above procedure performed by mobile device MD1 by broadcasting the discovered network service information NSI1 using its own secondary communications channel having a range R4. In turn the network service information NSI1 is received, and therefore discovered, by mobile device MD5. Mobile device MD5 is then able to configure itself for connection to the network N1 using the network service information NSI1 obtained using the above-described collaborative discovery method.

Other mobile devices in the system, such as mobile devices MD2 and MD3, will operate the same collaborative discovery method, passing on any network service information discovered. This leads to a widespread dissemination of network service information and allows a mobile device using this method to build up a complete picture of the available networks and services as well as other information relating to these networks and services such as quality, performance and pricing of the networks and services. It will be appreciated that the network service information need not comprise information relating to both a network and a service, but could comprise information relating to only one of these.

It has been described above how a collaborative discovery method embodying the present invention can supply the mobile device MD5 with the necessary network configuration data to allow it to configure itself to communicate over an available network. With re-configurable mobile devices, or even single-mode devices capable of switching to a different network based on the same network technology (type), the network service information obtained from other mobile devices using a method embodying the present invention can also be used to effect a re-configuration of the mobile device, as will now be described.

In Figure 2, the mobile device MD4 is already configured to communicate over the network N3, but has received network service information NSI1 from the mobile device MD1. The network service information NSI1 contains network configuration data relating to the network N1 as well as network performance data relating to the network N1. Upon receipt of this network service information NSI1, the mobile device MD4

could determine that the network N1 is in fact offering superior communication performance to the network N3 to which it is already connected. As a result, the mobile device MD4 could perform a re-configuration procedure based on the network service information NSI1 and re-configure itself to communicate instead over the network N1.

The network service information NSI1 also contains service configuration data relating to the service S1 which the mobile device MD1 has been using. This service configuration data could also be used by mobile device MD4 as a basis for switching from network N3 to network N1 if the service S1 is required by the user of the mobile device MD4 and the service S1 is only available over the network N1.

Figure 3 is a schematic illustration of the network and service connections following the configuration of mobile device MD5 to communicate over network N1 and the re-configuration of mobile device MD4 to communicate over network N1 and to receive service S1.

Many protocols exist for the advertisement and discovery of services and these protocols could be used in an embodiment for the distribution of network service information. In one implementation, the network service information could be presented in a descriptive mark-up language such as XML (Extensible Markup Language) within the Resource Description Framework (RDF). The use of such descriptive languages enables the network service information to have a very rich content, imparting significantly more information than could be derived from simply scanning the radio spectrum.

Figure 4 is a diagrammatic representation of the network service information expressed in such a format. As can be seen from Figure 4, the network service information is broadly sub-categorised into "network information" and "service information". The former is sub-categorised into "general", "quantitative" and "qualitative" information and the latter is sub-categorised into different services. Examples of information in the "general network" sub-category are the network name, operator name, network technology, access status, donor location, validity period, basestation/access point identifier, modulation scheme and spreading code. Information within the "quantitative

network" sub-category can include the received signal strength indicator (RSSI), transport channel block error rate, signal-to-noise ratio (SNR), transmit power, operating frequency range, carrier frequency, channel bandwidth, bit error rate (BER) and latency. Information in the "qualitative network" sub-category includes the network loading rating and the quality-of-service (QoS) rating. Within each service sub-category, information can include the name of the service, the type of the service (for example, MMS or A/V streaming) and the cost associated with the service.

The secondary communications channel described above can be, for example, a Bluetooth channel or any other type of wireless channel, for example an infrared or WiFi channel. The advantage of using a secondary communications channel different to the primary communications channel used for communications over the primary network is that network service information can be transmitted without affecting access to the network and services provided over the primary communications channel. However, it is also possible that the primary communications channel is used to transmit and receive network service information; the time taken for this purpose would not be as great as a conventional spectrum-scanning approach.

One of the main issues concerning the choice of technology for the secondary communications channel is coverage. In an ad hoc network, devices are connected if they are directly within range of another device. In one embodiment of the present invention, devices will pass on network service information by broadcasting it to any other device within communication range, who will in turn pass it on to others. Thus a device can receive network service information if there is a path between it and the device that originally obtains the information. Such a device is then within coverage of the originating device. Simulations can estimate coverage for secondary communication channel technologies with different transmission ranges.

Figure 5 shows, for a variety of different densities of mobile devices (measured in devices per square meter), the transmission ranges required to give 90% coverage (assuming that devices are distributed uniformly randomly in a fixed area). To provide some context to the density values, 0.01 devices per m^2 corresponds to the expected density in a busy shopping centre or airport, while 0.15 devices per m^2 would typically

be the density in a crowded bar or restaurant. For 90% coverage in the first of these two scenarios, the secondary communications channel requires a range of at least 15m. For the second scenario, a range of only 5m is required. For lower densities than 0.01 devices per m^2, a higher transmission range would be required.

Bluetooth technology provides three main power classes. Power class 3 is the most prevalent, being the class typically found in small mobile devices. Power class 3 has the lowest output power of the available power classes, and is therefore the most efficient, but only has a range of 10m. Power class 1 is used in larger access points, and has a range of 100m. Power class 2 provides a range between power class 1 and power class 3.

If a larger range (and therefore greater coverage) is required, then IEEE 802.11b technology can be employed, which has a typical range of up to 100m.

Another alternative would be ultra wide band (UWB) technology which is in development but which is expected to have a range of about 10m. However, there is the possibility for higher power levels and therefore wider ranges, and in addition the UWB technology has a very low power consumption and some useful properties relating to location estimation.

The network service information provided by the mobile devices in a system is preferably distributed to other devices in the system near-instantaneously to provide a live and accurate representation of the available networks and services at that time and location. The network service information could comprise time stamp data indicating the time when it was generated or updated by a mobile device and the validity of the information could be made dependent upon the time stamp data so that, for example, the network service information is deemed void after a predetermined length of time from the time indicated by the time stamp data. This would prevent the use and further dissemination of obsolete or out-of-date network service information.

Likewise, information relating to a network or to a service is often only appropriate within a particular area, with mobile devices outside the area being unable to use that

network or service. The use of a short-range secondary communications channel will act partly to restrict the dissemination of network service information to within a local area, but the network service information could also comprise location stamp data indicating the location at which it was generated by a device and the validity of the network service information could be made dependent upon the location stamp data. For example, the network service information could be deemed void when at a device which is a predetermined distance from the location indicated by the location stamp data. Alternatively, the network service information could comprise information specifying the area in which the network or service is available.

Although an embodiment of the present invention has been described above as having a plurality of mobile devices, it will be appreciated that fixed communication devices can also form part of the communications system over which the collaborative discovery method operates. Any type of fixed or mobile communication device can be used for this purpose.

Although it is shown in Figure 2 that the service provider SP1 provides a service S1 over the network N1 which is provided by the network operator NO1, and similarly for service provider SP2 and network operator NO2, it will be appreciated that a service provider is not restricted by any technical considerations to providing services over a particular network. For example, service provider SP1 could provide the service S1 over the network N2 or N3. Of course, there is also no restriction implied by network operators NO1 to NO3 providing their respective networks N1 to N3 from the base stations BS1 to BS3. In reality, base stations are usually shared by a number of network operators.

It is described above that a mobile device having network service information to be shared with other mobile devices broadcasts this information periodically for receipt by any other mobile device within range. The frequency of broadcasts is flexible and can depend on such factors as available battery power or mobility of the broadcasting device. Instead of broadcasting the network service information, a device could also transmit the information directly to another mobile device. Direct transmission or broadcasting of the information could be initiated on the request of another mobile

device. Such requests for network service information, which may themselves be broadcast, may be performed periodically to keep an accurate picture of available networks and services in the vicinity, or on demand, for example prior to a re-configuration operation.

An embodiment of the present invention does not involve the scanning of spectrum and is therefore less time consuming than conventional methods. Directly related to the amount of time that spectrum scanning techniques take to complete is the amount of power such procedures would consume. It is important that power consumption is minimised since mobile devices are reliant on limited power supplies. An embodiment of the present invention is far more power efficient than conventional discovery techniques. One embodiment of the present invention can also utilise low-power, short-range radio links to transmit network service information to achieve a more power-efficient distribution. An embodiment of the present invention enables a re-configuration procedure to be completed in a very short time compared to conventional procedures in which a lengthy discovery process must first be completed.

A collaborative discovery method according to an embodiment of the present invention may be enabled on a communication device either through hardware or software, or a combination thereof. An operating program to enable the discovery method to be performed on a communication device may be stored on a device-readable medium, but could also, for example, be embodied in a signal such as a downloadable data signal provided from an Internet website. The appended claims are to be interpreted as covering an operating program by itself, or as a record on a carrier, or as a signal, or in any other form.

CLAIMS:

1. A collaborative discovery method for use by a plurality of communication devices, wherein network service information discovered by any device of the plurality is made available for sharing with and discovering by at least one other device of the plurality by transmitting the network service information wirelessly to the at least one other device, the network service information relating to at least one of a network over which a device of the plurality can communicate and a service which a device of the plurality can use.

2. A method as claimed in claim 1, wherein the network service information comprises network configuration data relating to a network that enables a device to be configured to communicate over that network.

3. A method as claimed in claim 2, wherein the network configuration data comprises one or more radio physical layer characteristics of the network concerned.

4. A method as claimed in claim 3, wherein the network configuration data comprises the operating frequency range of the network concerned.

5. A method as claimed in any preceding claim, wherein the network service information comprises service configuration data relating to a service that enables a device to use that service.

6. A method as claimed in any preceding claim, wherein the network service information comprises network performance data relating to the performance of a network.

7. A method as claimed in claim 6, wherein the network performance data comprises a Quality of Service indication for the network concerned.

8. A method as claimed in any preceding claim, wherein the network service information comprises information identifying a network and/or service.

9. A method as claimed in any preceding claim, wherein the network service information comprises costing information relating to a network and/or service.

10. A method as claimed in any preceding claim, wherein a plurality of different network types are available and at least one device of the plurality is capable of communicating over more than one network type.

11. A method as claimed in claim 10, wherein one of the network types is a GSM network.

12. A method as claimed in any preceding claim, wherein each device of the plurality uses a primary communications channel to communicate over a network and at least two devices of the plurality have a secondary communications channel, different to the primary communications channel, for transmitting the network service information between the at least two devices.

13. A method as claimed in claim 12, wherein the secondary communications channel is a Bluetooth communications channel.

14. A method as claimed in claim 12 or 13, wherein the primary communications channel is a GSM channel.

15. A method as claimed in any preceding claim, wherein the network service information is transmitted from a device following a request received from another device.

16. A method as claimed in claim 15, wherein the request is broadcast.

17. A method as claimed in any preceding claim, wherein the network service information is broadcast periodically by a device for receipt by any other device within range of the broadcast.

18. A method as claimed in any preceding claim, wherein the network service information is generated by a device that has connected to the network and/or used the service to which the information relates.

19. A method as claimed in any preceding claim, wherein the network service information comprises time stamp data indicating the time when it was generated or updated by a device and the validity of the information is dependent upon the time stamp data.

20. A method as claimed in claim 19, wherein the information is deemed void after a predetermined length of time from the time indicated by the time stamp data.

21. A method as claimed in any preceding claim, wherein the network service information comprises location stamp data indicating the location at which it was generated by a device and the validity of the information is dependent upon the location stamp data.

22. A method as claimed in claim 21, wherein the information is deemed void a predetermined distance from the location indicated by the location stamp data.

23. A method as claimed in any preceding claim, wherein at least one of the devices is a mobile communication device.

24. A method as claimed in any preceding claim, wherein a service is provided over a network.

25. A method of configuring a communication device for connection to a network using network configuration data obtained using a collaborative discovery method as claimed in claim 2, 3 or 4, or any one of claims 5 to 24 when dependent on claim 2.

26. A method of reconfiguring a communication device connected to a first network for connection to a second network, different to the first network, based on network

service information obtained using a collaborative discovery method as claimed in any one of claims 1 to 24.

27. A method as claimed in claim 26, wherein the communication device is reconfigured based on network performance data of the network service information.

28. A method as claimed in claim 27, wherein the network performance data relates to the performance of the first network.

29. A method as claimed in claim 27 or 28, wherein the network performance data relates to the performance of the second network.

30. A communication device adapted to perform a collaborative discovery method as one of a plurality of communication devices, in which network service information discovered by the device is made available for sharing with and discovering by at least one other communication device of the plurality by transmitting the network service information wirelessly to the at least one other device, the network service information relating to at least one of a network over which a device of the plurality can communicate and a service which a device of the plurality can use.

31. An operating program which, when loaded into a communication device, causes the device to become a device as claimed in claim 30.

32. An operating program which, when run on a communication device, causes the device to perform a collaborative discovery method as one of a plurality of communication devices, in which network service information discovered by the device is made available for sharing with and discovering by at least one other communication device of the plurality by transmitting the network service information wirelessly to the at least one other device, the network service information relating to at least one of a network over which a device of the plurality can communicate and a service which a device of the plurality can use.

33. An operating program as claimed in claim 31 or 32, carried on a carrier medium.

34. An operating program as claimed in claim 33, wherein the carrier medium is a transmission medium.

35. An operating program as claimed in claim 33, wherein the carrier medium is a storage medium.

36. A collaborative discovery method substantially as hereinbefore described with reference to Figures 2 to 5 of the accompanying drawings.

37. A method of reconfiguring a mobile device substantially as hereinbefore described with reference to Figures 2 to 5 of the accompanying drawings.

38. A method of configuring a mobile device substantially as hereinbefore described with reference to Figures 2 to 5 of the accompanying drawings.

39. A communication device substantially as hereinbefore described with reference to Figures 2 to 5 of the accompanying drawings.

Application No: GB0401129.2 **Examiner:** Hannah Sylvester

Claims searched: 1-35 **Date of search:** 6 July 2004

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular reference
X	1-18 and 23-35	EP1246487 A3 (TOSHIBA) see whole document and in particular paragraph 0014
X	1, 2, 5, 8, 10, 30, 31 and 32	GB2361603 A (NOKIA) see whole document
X	at least 1, 30 and 32	EP1137240 A (BOSCH) see abstract

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[W] :

H4L

Worldwide search of patent documents classified in the following areas of the IPC[07]

G06F; H04L; H04M; H04Q

The following online and other databases have been used in the preparation of this search report

WPI EPODOC PAJ